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ABSTRACT

This study examined female preservice teachers' perceptions of gender differences in the learning and use of computer technology, examining: how they compared themselves to males with regard to computer technology; at what skill levels they rated themselves with regard to various educational technology applications; how levels of self-esteem equated with frustration when they worked with technology; and how they rated the effectiveness of their technology training with their teacher education program. Data from surveys of 45 student teachers and an interview with 1 student teacher related to the survey indicated that there were four overlapping themes: gender bias on the part of females (most thought that men knew more about and were more enthusiastic about computer technology); low self-esteem with computer technology and evidence of frustration; medium enthusiasm and competency levels in various educational technology programs; and an opinion expressing weakness in the technology training received from teacher education classes. The findings suggest that female teachers would be reluctant to embrace computer technology in the classroom and that teacher education programs do not do enough to encourage computer literacy among female students. (Contains 17 references.) (SM)

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A Technology "Gender Divide": Perceived Skill and Frustration Levels Among Female Preservice Teachers

It is no longer a question of whether computers will enter the education arena. It is more a question of how many there will be and what they will be used for. Computer labs are in use by schools all across the country, and it is commonplace to find up to several computers in a classroom. There is no reason to assume that this ratio of student to computer will not continue to rise. Whereas public perception of technology in the classroom may be a positive one, what is not clear is whether the number of computers in classrooms equates to their productive use: for instance, a US Department of Education survey reported that only 20% of teachers felt they could use computer technology in their classrooms (Auther, 1999).

Research indicates that one reason for this low figure is that female teachers, who comprise most of the education profession, tend to show a greater reluctance to use computers and more anxiety when using them than do their male counterparts (Brosnan, 1998). More markedly, females have been found to have generally lower levels of performance at tasks involving computers (Corston & Colman, 1996). Are most of these computers simply reposing idly in their work stations, or are teachers meeting expectations by using them to enhance the technology skills of their students?

Current studies on gender differences in using computer technology show similarities to the landmark studies of the 1980s indicating a remarkable difference in math achievement scores between male and female high school students. The math studies were the springboards for efforts that have since been made to seek solutions that address the gender imbalance. In the late 1990's, when computer technology entered the classroom on a permanent basis, researchers had just scratched the surface of a similar phenomenon: males appear to have better skills and less anxiety when using computers than do females. This could have telling ramifications in elementary and middle schools

where most of the teachers are female, and where the expectation is that lessons involving computer skills will be taught. Will the majority of female teachers be reluctant to engage their students in computer work? Will this reluctance result in students not learning fundamental computer skills in the early elementary years?

Review of Literature and Rationale

Research at various levels indicates a gender difference in two threads that appear to overlap: computer competence and anxiety or frustration levels. A study of computer assisted instruction (CAI) at the first-grade level concludes that just as gender socialization is related to gender differences in math, science, and reading achievement, quite possibly it is also related to gender differences in computer use (Erdner, Guy, & Bush, 1998). In higher education, moreover, 202 college students were studied, resulting in the conclusion that females were less interested in computers, less confident, and less experienced than males (Shashaani, 1997). At the college faculty level, it has been shown that males rate themselves as having a higher level of knowledge and experience in using advanced computer technologies than females (Spotts, Bowman, & Mertz, 1997).

Furthermore, an extensive, multi-national study of gender differences in 10 advanced countries indicates that "females know less about information technology, enjoy using the computer less than male students, and perceive more software problems" (Reinen & Plomp, 1996, p. 65). More recently, a report on gender differences in computer anxiety indicates a higher index in undergraduate females, and that 64% of females agreed that computing was a male activity, that men were better at computing than women (Brosnan, 1998). A related study on class enrollment shows a probable cause of gender imbalance in programming-oriented courses to be attributed to a lack of computer experience by females (Charlton & Birkett, 1998). As our society becomes more technology-driven, the ultimate question may be whether gender inequities may lead to career economic ones as well (Weinman & Haag, 1999).

Reasons for male predominance in computer technology vary. Whereas home computer access for females relates to initial success for females (Dugdale, DeKoven, Ju, 1998), the presence of a computer at home is no guarantee that females will use it: 70% of students polled indicated that males are the primary users at home, especially since parental role models are mostly the working fathers (Shashaani, 1998). With implications for students' later interest in computers, action game software is largely written for the male audience, perceived as being more interested in the technology medium (Bland, 1995). One study indicates that only 6% of respondents could identify any software with female characters (Levin & Barry, 1997).

Suggestion is also made that teacher influence and role modeling has an important role. Computers have been judged to be more a part of the male-dominated math/science curriculum than of English in high schools, and a predominance of these teachers became the computer teachers (Lee, 1997). When coupled with girls' perceptions that they were not given the same encouragement to take math/science courses to the extent their brothers were, (Shashaani, 1997), girls simply found themselves underrepresented in courses that worked with computers.

Is there any action being taken on the problem of gender inequality? The Reinen international study indicates that in most countries, only a small minority of schools have formulated special programs regarding computer use to deal with the gender issue, these focusing primarily on training female teachers and in-service sessions on equity (1997).

Has enough research been done on the problem to be conclusive? Fact is, widespread use of computers in schools has emerged to varying degrees (e.g. wealthy districts vs. poor districts) in perhaps just the last five years, and extensive studies of gender differences are scant when compared to those examining the gender factor in mathematics. What there are of these, however, are uniform in their conclusion regarding higher male achievement, both perceived and actual, in computer technology. If it can be assumed that the American ideal of equal opportunity for both boys and girls is still an

important driving force in the educational system, then more information and data need to be gathered and analyzed to effectively address the problem, especially in the arena of the preservice teacher. Theoretically, preservice teachers who graduate and obtain valid teaching credentials begin their careers with foundations in technology as adequate as any other classroom skill area. Similarly, principals searching for new teachers are entitled to have expectations that new teachers will readily utilize this technology. If this study corroborates earlier research, the implied similarity in computing backgrounds of female and male teacher candidates may have to be reassessed to account for possible gender differences related to technology learning and use; hence, the rationale for this study.

Purpose of the Study

The purpose of this study was to examine female preservice teacher perceptions of gender differences in the learning and use of computer technology, as well as to provide insight into attitudes that might affect their future performance in classrooms situations.

The following questions guided this study:

1. How do female preservice teachers compare themselves with males with regard to computer technology?
2. At what skill levels do female preservice rate themselves with regard to various educational technology applications?
3. How do levels of self esteem equate with frustration when female preservice teachers work with technology?
4. How do female preservice teachers rate the effectiveness of their technology training in their Teacher Education program?

Method

Participants

The site of this study was the College of Education at a large (enrollment 22,000) urban university. At the time of the study, Spring, 2000, there were 125 students

enrolled in preservice teacher classes called ICL 4800--Professional Seminar. These students were all involved in student teaching during the day, were in their last semester of their degree programs, and provided the source of data collection for the analysis.

Data collection

A survey/questionnairewas distributed to most of the students in the preservice teacher program through the cooperation of their instructors, and 45 responded. The instrument was prepared with the advice and cooperation of seven College of Education faculty members, including three members of the Instructional Design & Technology Department and one Educational Psychology Research Department faculty member. It contained 35 items, many of which were Likert-type items based on a 1 = low, 5 = high scale, and others calling for a dichotomous "yes" or "no" response. An open-ended question at the end of the survey/questionnaire asked respondents to recount their worst problems with computers and how it was solved.

The focus interview questions were related to the questionnaire and provided in-depth comments not only on how one participant felt toward technology matters as an individual but on the reactions to technology of others that she had observed in the course of her experiences in education classes. The duration of the interview was 45 minutes. The interview was audiotaped and transcribed.

The preservice teacher made it clear that she intended to pursue a teaching career, and had volunteered to participate in the interview session. The interview took place in the office of a professor in what could be considered a casual setting. The interviewee was advised of the reason for the interview, that should her comments be used in the study her name would remain anonymous, and that her reaction would be recorded. Rapport with the participant had been established through a classroom connection. She seemed like a bright student, aware of her surroundings, and firm in her convictions.

Data Analysis

Data was analyzed at the completion of the study using both quantitative and qualitative methods in a mixed-methodology design, the purpose of which was to triangulate findings in order to demonstrate convergent results (Creswell, 1994). Qualitative methods have been shown to help clarify phenomena, add contextual information, and to examine issues in depth (Patton, 1990; Marshall & Rossman, 1999). Each data set was examined for overlapping material which contributed to identifiable themes and categories (Glaser & Strauss, 1967). The survey/questionnaire provided the source of quantitative data, while the open-ended question and the focused interview were the sources for qualitative data.

Limitations of this study

This research study made no attempt at any meaningful generalization beyond the scope of its limited base of data. The fact that it is drawn from only one school from one part of the country at one time of the year is a decided limitation. A focused interview with just one individual is a further limitation.

Analysis and Interpretation

Of the 45 female preservice teachers who responded to the survey/questionnaire in the Professional Seminar classes, 30 were chosen at random for the analysis. The answers to the Likert-type questions and the responses to the "yes" or "no" questions were average by simple mathematical calculations.

The findings produced four identifiable, if somewhat overlapping, themes that relate to thepurpose of the study: 1) a gender bias on the part of females, 2) low self-esteem with computer technology and evidence of frustration, 3) medium enthusiasm and competency levels in various educational technology programs (CT), and 4) an opinion expressing weakness in the technology training received from Teacher Education classes.

Gender Bias

One theme that emerged from the survey/questionnaire was an evident gender bias on the part female preservice teachers, as follows:

- 85% thought that men knew more about computer technology (CT).
- 86% felt that men were more enthusiastic than women when it came to CT.
- 85% felt that they were at a greater disadvantage than men when it came to CT learning.
- 86% said that men are better able to solve a complex computer problem.

These findings corroborate earlier research showing that most females view CT as a masculine domain (Brosnan, 1998; Weinman & Haag, 1999). The findings suggest that a lack of their own strong knowledge base of CT has led to the perception of men being stronger in this field which, in turn, could engender a defeating, non-competitive, non-challenging stance toward the learning and use of CT. Further, an admission that they cannot solve problems as well as men could mean an unwillingness to expose themselves to technology difficulties in the first place.

Low Self-Esteem

The response to the question regarding a gender bias, in which 86% of females saw themlelves at a greater disadvantage when it came to learning about could be viewed as pivotal. One interpretation of this figure is that it is evidence low self esteem, in that there is no reliable research to suggest that women are ever at a learning disadvantage to men in any field of endeavor. If women see themselves as disadvantaged in CT, they may see themselves less likely to attempt to learn new skills with CT.

Qualitative findings from the written response on the questionnaire appear to support the low-self-esteem analysis: The question read, "Briefly describe your worst experience with a computer, your reaction to it, and what you did about it. (i. e., whom

you asked for help)." The purpose of this question was to measure frustration and reaction levels among the responding preservice teachers. Thirty-six percent of the total responded to this questionnaire item. 15% stated that they tried to solve the problem themselves. 20% sought help from outside sources: lab assistant, dad, brother, brother-in-law, friend of my father, technician, the computer company: what these all have in common is that they were all asked for help in solving a difficulty that a preservice teacher was having with a computer.

On the surface, it would appear that the preservice teachers were using good judgment in calling for help in any quarter. But the data indicate that many of them had problems that could have been solved by themselves in far less time, in ways such as simply saving material to disk as they work, and rebooting the system after a crash. What this suggests is that many preservice teachers do not have adequate attack skills for problem solving CT difficulties, and that at some juncture in their initial course work they should be provided with instructions which include step-by-step solutions training. This would help eliminate a great deal of frustration of the part of preservice teachers who might otherwise become unnerved by difficult experiences. It would also train them to troubleshoot situations as they arise in their future classrooms.

Furthermore, the interviewee reported that she felt there was a general low level of self esteem among women when it came to CT. "Women have no idea what they are talking about," she said. "Women are afraid to work on computers in all my classes, she continued, "Women are scared of 'em. I've never seen a male who's like that."

In sum, it is not entirely clear whether these gender biases by female preservice teachers will actually result in a disinclination to use available technology in the classroom. There is always the possibility that the gender issue will be ignored by females, and that they will go forth and embrace CT in the classroom with enthusiasm any way. However, when coupled with other findings, serious doubts arise.

Enthusiasm and Competency Levels

As measured by the Likert-like scale 1 = low, 5 = high, the survey/questionnaire showed the following:

- Level of enthusiasm for CT = 3.6
- Preparation to teach word processing lessons = 4.3
- Preparation to teach Internet lessons = 4.0
- Preparation to teach database lessons = 3.1
- Preparation to teach spreadsheet lessons = 3.1

This segment of findings represents how the female preservice teachers rate their personal level of enthusiasm toward CT, as well as their own skill levels with common classroom computer functions. The 3.6 level of enthusiasm for all respondents suggests that there is just a little better than average chance that they are willing to abide the challenge of what CT has to offer. Of the respondents, only 13% reported that they had a very high level of enthusiasm for CT. This poses the question of whether the majority of preservice teachers will have the necessary eagerness to jump into a technology mode in the classroom.

The numbers for word processing are the highest, suggesting that preservice teachers feel most comfortable teaching lessons in that medium. A closer look at the data showed, however, that 47% did not report themselves as being "well prepared." Thus, even at the basic word processing level, there is some evident weakness. This could be cause for concern where language arts teaching, since word processing enhances language development.

The next highest Likert level was a 4.0 indicating a moderately strong inclination to use the Internet in class lessons. Looking closer at the data, however, a full 25% said they felt only poorly to moderately prepared, a result that could indicate that this quarter of the respondents will probably not get involved with Internet lessons. Since the

Internet is a valuable information resource, it would appear that many teachers in the disciplines such as History, Social Studies, and Science, might not avail themselves of this opportunity to enhance learning.

The somewhat low survey responses for preparation to teach using the functions of database and spreadsheet suggests that perhaps there will be few math lessons taught using these important technology tools.

Lastly, from the HyperStudio and PowerPoint questions, calling for a "yes" or "no" response, 36% said they could build and present a HyperStudio stack, while 60% said they could create and use a PowerPoint presentation. These two findings indicate that these two powerful forms of computer classroom presentations have not been learned to a great extent by the female preservice teachers responding. Although HyperStudio and PowerPoint are only indirectly related to classroom content, they are nevertheless shown to be effective technology vehicles for presenting materials to large groups. In addition, if teachers do not know how to instruct comfortably with the two media, they will probably not teach the skills to their students. This would result in the students not learning an important group communication enterprise themselves.

Opinion of Teacher Education

Of the preservice teachers, 38% noted that they felt Teacher Education had not prepared them well enough to teach technology lessons in the classrooms. The class associated most with learning how to develop classroom computer lesson is the methods class.

The interviewee was pointed in her remarks about what she felt toward her technology education. When asked to describe the strengths of her methods class regarding the teaching of CT, she replied, " I don't think there were any strengths. None whatsoever. I don't think highly of my methods class." And about the students in it: "They just want an easy grade. That's all they care about." When added to negative comments about her instructor, it became a clear indictment of her particular Methods

class. It is entirely possible, of course, that the individual spoke only for herself, but taken in the context of the questionnaire findings, 38% reporting that Teacher Education did not prepare them well enough to teach computer lessons, her comments add support to the suggestion that such classes have not been serving the preservice teachers as a whole.

If better than one third of the subjects will probably not teach technology components in the class during this renaissance era in American society, then their students will, in effect, be falling behind by standing still. This low opinion of Teacher Education technology training by preservice teachers suggests that what is needed are any or all of the following: a higher number of required CT courses, a restructuring of the current offerings, the development and implementation of a computer-competency information survey that all in-coming students must complete.

Conclusion and Implications

The gender disparity in the field of computer technology, as it has been perceived by the subjects in this study and reported in the literature, has important implications for the field of education. The most telling research statistic in this regard, from the US Department of Education survey, showed that just 20% of teachers felt they could use technology in the classroom (Auther, 1999). Although it has certainly not sparked the controversy that the gender differences in math achievement scores did in the past, enough evidence has been generated to give cause for concern that women see themselves disadvantaged when learning computer technology. This perceived disadvantage, in the form of low self esteem, could seriously undermine efforts in education to teach computer skills to elementary students, since most of the teachers at this level are female. The findings of this study may have implications for future teachers as they enter the work force. If the findings are significant, the information may be of value to prospective employers, especially those schools that emphasize technology. Will their interview questions be focused on the candidates expertise in

computer technology? Will females, then, be at a disadvantage in employment opportunities? There are similar implications for schools seeking to keep up to date with technology teaching: Will elementary schools be unable to find suitable young teachers trained in technology? And for the Teacher Education programs, implications might mean taking a strong look at restructuring the curriculum to include more technology courses, or redesigning existing courses in ways to boost the level of female confidence in computer work.

Regarding frustration levels, certainly the vast majority of CT users have had to overcome difficulties, but where some will go on to experiment and create, others will remember the pain and stay within certain comfort boundaries. It is not the latter that will produce creative teachers. Not only does it appear that female teachers will be reluctant to embrace technology in their classroom, but there is little strong evidence showing that they can utilize common lesson-planning computer functions such as spreadsheet and database, thus seriously jeopardizing the teaching of new concepts in math and science education. This alone should be a serious issue, given the concern in the United States that the US lags behind other industrial nations in the teaching of math and science.

Finally, the findings of this and earlier studies appear to implicate Teacher Education programs. There is no research to show that female students cannot learn to use computer technology as proficiently as male students if given the opportunity. Some females do report a high degree of enthusiasm for the technology and a certainty that they will teach it in the classroom, but this is not widespread. Research does suggest that one reason women are behind men is that they did not engage in having "fun" with computer games at an early age the same way men did, and these activities apparently have helped men understand the challenges of the computer and what they are capable of doing. Recognizing the impossibility of going back in time, Teacher Education might want to create more enjoyable, less frustrating units in its Methods classes, rather than jumping

into purely practical considerations. This would facilitate a bonding of the female with the machine in the same way that occurred with the male in earlier days. All of this suggests a correlation between having fun with CT and a willingness to be creative with educational aspects of CT. These responses suggest that if CT classes were designed to be more enjoyable they might have a higher success rate.

There is current political talk in the United States of a so-called "Digital Divide," which describes the differences in opportunities between those students with computers and those without. But for some reason there seems to be less of a concern with what to do with a computer once it becomes available on a desk. There are lots of computers in elementary classes not being used in this country today. The reason for this might have more to do with a "gender divide."

Further research on gender inequities in technology is necessary. Not only should a wider population sampling be included, but an examination of such areas as race, early home computer experience, numbers of computer classes, levels of enjoyment of arcade games, and possible role modeling all could add to the literature and help understand a subject that is frought with issues.

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